NASA STRATEGY FOR RISK ASSESSMENT

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OUTLINE

- **Objective**
- **Motivation**
- **Best PRA Values**
- **Current Status at NASA**
- **Needs and Approaches**
- **Organizing the Effort**
- **On-Going and Planned Activities**
- **Key Elements for Success**

OBJECTIVE

Develop a world-class in-house capability to perform, manage, and use Probabilistic Risk Assessment (PRA) methods at NASA

MOTIVATION

In modern technological applications, PRA has proven to be a systematic, logical, and comprehensive tool to assess risk (likelihood of unwanted consequences) for the purpose of:

- Increasing safety in design and operation
- Saving money in design, manufacturing or assembly and operation

NECESSITY OF PRA

At NASA, PRA is necessary (N) and/or appropriate (A) for:

	N	A
– Obtaining Presidential approval for launch of certain quantities of nuclear materials (e.g. Galileo, Ulysses, Cassini)	X	X
– Analytically demonstrating satisfaction of planetary protection requirements (e.g., Mars Sample Return)	X	X
– Supporting decision making for design and modification of space systems (e.g., Space Shuttle, ISS, CRV)		X

In fact, NASA has performed, is performing, or intends to perform PRA for most of the preceding examples

PRIMARY PURPOSE OF NASA HQ PRA EFFORTS

- The primary purpose is to assure that if and when NASA does perform PRA, we do it properly and produce a quality product that we understand and know how to use.
- The primary purpose is not to “sell” PRA or demand PRA.

PRA IS OF MOST VALUE WHEN WE HAVE

- In-house expertise to perform and manage PRAs
- In-house ownership and corporate memory of PRA methods, tools, databases, and results
- Lowest dependence on outside consultants to perform and manage PRAs and to control databases and computer tools

CURRENT STATUS AT NASA

- Experience with traditional FMEA
- Some experience with FTA
- Great overall interest in and management support for performing PRA
- Scarce and scattered PRA resources
- Inadequate communication/cooperation on PRA among centers
- No corporate memory on PRA work/data

NEEDS AND APPROACHES

- Integrate and coordinate PRA efforts throughout NASA
  - Develop and implement NASA PRA policy
  - Coordinate needs for and use of technical assistance from other centers, HQ, consultants
  - Retain decentralization of PRA project management and performance but centralize the PRA ***process*** NASA-wide

NEEDS AND APPROACHES

- Skilled in-house personnel resources
  - Train (classroom and on-the-job)
  - Strategic hires
  - Temporary transfers from other Government organizations
  - Use of loaned/seconded experts from industry/university
  - Consultants to transfer technology, complement resources and for specialized analyses

NEEDS AND APPROACHES

- NASA-wide baseline PRA procedures, standards and tools
  - Develop PRA standards and procedures guide to perform PRA for aerospace applications
  - Adopt “baseline” state-of-the-art PRA computer tools (e.g., government developed SAPHIRE)
  - Develop other state-of-the-art NASA PRA computer tools (e.g., QRAS, Dynamic fault tree analysis tool)

NEEDS AND APPROACHES

- Coordinate and maintain PRA databases for NASA application categories
  - Design engineering information
  - Component and system reliability
  - Maintenance, test and repair data
  - Initiating events lists and frequencies

NEEDS AND APPROACHES

- NASA infrastructure to effectively use limited-size cadre of in-house PRA experts
  - NASA-wide awareness of where the PRA resources, knowledge and data are
  - Regular inter-center communication, and sharing of people, tools, data, lessons learned
  - Environment for synergistic NASA-wide cooperation in PRA efforts

ORGANIZING THE EFFORT

- NASA HQ to:
  - Organize/conduct/coordinate awareness and practitioner PRA training
  - Develop PRA standards, requirements, procedures, guidelines
  - Mentor and provide specialized assistance
  - Coordinate use of PRA computer tools
  - Coordinate use of outside consultants
  - Manage the PRA ***process***, oversee quality

ORGANIZING THE EFFORT

- Expert PRA Groups, one at each center, to
  - Disseminate PRA information throughout NASA
  - Help projects organize, staff, perform, manage PRA efforts at the center
  - Assist/perform training
  - Assist other centers on as-needed basis
  - Serve as local custodians of PRA software, data
  - Work with HQ, support NASA PRA strategy

ON-GOING AND PLANNED ACTIVITIES

- PRA strategy development - summary here
- Develop awareness and practitioner training for HQ, Centers, APPL - one completed
- Develop requirements for state-of-the-art computer programs - task initiated
- Develop PRA Procedures Guide for aerospace applications - outline reviewed

ON-GOING AND PLANNED ACTIVITIES

- Cooperation with other Government agencies - June 27, 2000 meeting with NRC
- Acquire SAPHIRE code and arrange training for it - June 20-23, Aug. 15-18, +
- Evaluate/incorporate QRAS improvements
- Collect information on past/present/future PRA efforts (people, tools, data, projects, consultants)

ON-GOING AND PLANNED ACTIVITIES

- Organize one-day kick-off meeting for NASA-wide PRA information sharing
- Develop mechanisms to maintain NASA-wide PRA information exchange (telecons, meetings, conferences, working groups)
- Develop/organize seminars/workshops on PRA and risk management use in NASA management decisionmaking

KEY ELEMENTS FOR SUCCESS

- **NASA-wide PRA policy and procedures**

  (e.g. NPD)

  – **Standardization** of "baseline" PRA methods, programs, procedures, data collection
- **NASA-wide PRA integration and coordination**
  – **Coordination** through HQ of PRA projects, PRA training and use of PRA consultants
  – **Monitoring and control** of the ***PRA process and PRA*** **quality**